ORIGINAL ARTICLE

Development of a novel questionnaire to assess knowledge, attitude and practice towards medical disorders in pregnancy among clinicians

Thai Lun Tan, MRCP[1], Shoen Chuen Chiew, BPharm[2], Qinglin Lau, MRCP[1], Thanusha, MRCP[1], Mahmoud Danaee, PhD[3], Manisha, MRCP[1]

[1]Department of Internal Medicine, Hospital Tengku Ampuan Rahimah, Ministry of Health, Selangor, Malaysia, [2]Clinical Research Centre, Hospital Seri Manjung, Ministry of Health, Perak, Malaysia, [3]Faculty of Medicine, Department of Social and Preventive Medicine, Centre for Epidemiology and Evidence-Based Practice, University of Malaya, Kuala Lumpur, Malaysia

ABSTRACT

Introduction: Maternal medicine is important and complex. It focuses on the care of mothers with comorbidities or medical disorders during pregnancy. To date, there are limited tools to assess clinicians' knowledge, attitude and practice (KAP) in this field.

Materials and Methods: This study aims to develop and validate a questionnaire measuring the KAP of clinicians towards maternal medicine. Literature reviews, item generation and multiple experts' reviews were conducted during the questionnaire development phase. Convenient sampling was undertaken for this cross-sectional survey. A total of 168 clinicians from one tertiary hospital and three health clinics participated in the pilot testing using the modified questionnaire. In addition, test-retest was performed on 30 participants to examine its reliability, whilst exploratory factor analysis (EFA) was undertaken to determine its construct validity.

Results: This finalised questionnaire contained 36 items with excellent content validity. Pertaining to test-retest reliability, all knowledge domain items showed Kappa values > 0.20, except item K29; attitude domain items overall Cronbach's alpha was 0.787 with corrected item-total correlation > 0.300 and lastly, all items in practice domain achieved intra-class correlation index > 0.700, except P2.5. EFA supported four factor structures, but six items were removed due to the following reasons: cross loading, negative or poor loading factor (< 0.3).

Conclusion: Overall, this instrument has an acceptable psychometric property, content validity, internal reliability and construct validity. It is hope that this questionnaire would be validated in other populations and be used in future research to enrich our understanding of clinicians' KAP towards maternal medicine.

KEYWORDS:
Knowledge, attitude and practice; questionnaire; medical disorders; pregnancy

INTRODUCTION

Maternal medicine is a specialised field that focuses on caring of mothers with pre-existing comorbidities or medical disorders that arise during pregnancy, who are at risk of pregnancy related complications.[1] It is generally regarded as a complicated field as medical disorders and pregnancy have bidirectional interactions, whereby a poorly controlled medical disorders would adversely affect the pregnancy outcomes, while stress and physiological adaptations during pregnancy could potentially exacerbate the underlying disease control.[2]

Due to the complexities of this condition, its management is underpinned by a multidisciplinary approach. The challenge starts before conception and continues with optimisation of disease control during pregnancy. Another pivotal aspect of care encompasses peri-conception medication modification to prevent teratogenic effects on the developing foetus. Furthermore, clinicians should also be cognizant regarding medication safety during lactation in order to prevent adverse complications to the nursing infants.[3,4]

Considering the above, it is evident that management of maternal medical disorders is multi-faceted and challenging. To date, Chuang et al demonstrated knowledge deficits about pregnancy-related risks in women with chronic medical diseases and lack of intent to participate in pre-conception health promotion and pregnancy planning.[5] Yet, little has been done to explore about the level of knowledge, attitude and practice (KAP) towards medical disorders in pregnancy among clinicians. Additionally, majority of the published questionnaires mainly focus on the single disease entity which only serve to provide a limited view towards maternal medicine.[6-8] In view of the foregoing, we undertook this study to develop and examine the validity and reliability of an evaluation instrument towards KAP of medical disorders in pregnancy among clinicians with the inclusion of five common medical disorders in pregnancy.

MATERIALS AND METHODS

Questionnaire Development

This questionnaire was a self-administered English questionnaire and answered by clinicians from both medical

This article was accepted: 10 January 2024
Corresponding Author: Thai Lun Tan
Email: tanthailun@gmail.com

department from a tertiary hospital and health clinics. It contained two sections, a) the respondents' demographic data and b) the KAP towards maternal medicine. Items to assess the KAP in this questionnaire were identified from systematic review of literature and rigorous discussion among the researchers.

In order to assess the knowledge towards maternal medicine comprehensively, we have included five representative disorders encompassing endocrinology, rheumatology, respiratory, neurology and haematology systems.[9-13] Area of knowledge tested was based on the disease epidemiology, clinical characteristics, natural history, prognostic features and pharmacology focusing on pregnancy as well as lactation compatibility, which was believed to be a part of the core knowledge of maternal medicine.[14]

A total of 34 multiple-choice knowledge questions were designed using 'true', 'false' or 'unsure' response categories. Correct responses to the knowledge question were given a score of 1, and incorrect responses or 'unsure' responses were given a score of 0. The eight attitude statements were designed using a Likert scale. Each statement was scored on a five-point scale as follow: strongly agree, agree, neutral, disagree or strongly disagree. Similarly, the nine practice statements were designed using a five-point Likert scale indicating their frequency of actions towards the practice statements. Item P1 included the answer options of < 10, 11 to 20, 21 to 30, 31 to 40 and > 40; whilst the rest of the items included the answer options of almost always, often, sometimes, seldom and almost never. Overall, high scores would indicate a good KAP towards maternal medicine.

Validation Process

Phase 1: Content validity and face validity

The content validation of this instrument was established by seven experts represented by local endocrinologist, neurologist, pulmonologist, haematologist, family medicine specialist and general physician, as well as non-native academician in maternal health. These experts reviewed the questionnaire independently and rated it based on three criteria: content relevance, representativeness and clarity.

Cognitive debriefing, which aimed to assess the face validation was performed on 10 respondents from different backgrounds ranging from medical officers to medical consultants working in the hospital as well as in health clinics after content validation. During the process, the respondents would be required to provide feedback regarding the appropriateness and clarity of the questionnaire via open-ended discussion. The time taken to complete the questionnaire was recorded.

All the feedback from the content and face validation were reviewed by the researchers. The items were either deleted, edited or remain unchanged after an in-depth discussion among the researchers. If the items were changed based on the expert advice, it would be further reviewed by the respective expert till a consensus was achieved. The final version of the questionnaire which consist of five demographic items, 30 knowledge items, seven attitude items and 11 practice items was pilot tested in the next stage.

Phase 2: Pilot testing (reliability analysis and construct validation)

This single-stage pilot testing was a cross-sectional survey and conducted from August 2021 till November 2021 at a single tertiary hospital and three health clinics located within the Klang district, Selangor, Malaysia. It aimed to examine the item analysis, reliability and construct validity of the questionnaire. The sample size required for a validation study was based on the statistical analysis used. With regards to the exploratory factor analysis (EFA), which was deployed to analyse the construct validity of knowledge items (total = 30), require a minimal sample size of 150 respondents. (Ratio of 5:1; 5 × 30 = 150).[15]

Convenient sampling method was chosen to recruit the clinicians from the four health centres. The inclusion criteria were clinicians working in medical department from the tertiary hospital and all clinicians working in the health clinics. All clinicians of the selected centres who met the inclusion criteria were recruited, except house officers.

Data collection was conducted by visiting each of the centres. The objectives and procedure of the study were explained in detail before written consent was obtained from the respondents. The questionnaire was a guided self-administered questionnaire. The clinician could clarify any doubts with the data collectors while answering with no time restriction. However, they had to complete and return the questionnaire on the same day. In addition, 30 clinicians were requested to participate in the test-retest session. They were informed that they would be approached by the researchers within 14 days period for retest.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) version 25 was used to conduct the statistical analysis. Both item content validity index (I-CVI) and scale content validity index (S-CVI) were calculated to determine the degree of appropriateness of this instrument in measuring the content intended. Items with I-CVI ≥ 78% were considered as appropriate. On the other hand, items with I-CVI between 70 to 78% would be revised and items with I-CVI less than 70% would be removed.[16] In addition, Kappa index was also calculated to measure the inter-rater agreement that adjusts for chance agreement. Items with Kappa index above 0.74 were considered as excellent, whilst 0.60 to 0.74 were good and 0.40 to 0.59 were fair.[17] Domain S-CVI/average of 0.90 or higher would be considered to have achieved excellent content validity.[18]

In order to examine its construct validity, EFA was employed using a polychoric correlation matrix using Factor Software, Version 12.01.02 dated 22nd December 2021. Tetrachoric correlation was a special case of the polychoric correlation applicable when both observed variables were dichotomous. Polychoric correlation was advised when the univariate distributions of ordinal items were asymmetric or with excess of kurtosis. If both indices were lower than one in absolute value, then Pearson correlation was advised. Factor analysis model for binary variables was applied.[19] The factor structure of the dichotomous questionnaire items was examined using principal components analysis (PCA) and promin rotation which enabled analyses based on a polychoric correlation matrix. In order to determine the number of factors to retain in the scale, parallel analysis was used.

For reliability testing, Kappa index was used for knowledge domains, whilst Cronbach's alpha and intra-class correlation (ICC) index were deployed for attitude domains. Lastly, ICC index was used for practice domains. Kappa values < 0.21 were considered as poor agreement, 0.21 to 0.40 were fair agreement, 0.41 to 0.60 was moderate agreement, 0.61 to 0.80 strong agreement and 0.81 to 1.00 were near complete agreement.[20] Items with Cronbach's alpha score more than 0.80 were very reliable, > 0.60 to 0.80 were reliable, >0.40-0.60 were quite reliable, >0.20-0.40 were rather reliable and 0.0-0.20 were less reliable.[15] In another note, we consider items with ICC values < 0.5 as poor reliability, values > 0.5 to 0.75 as moderate reliability, values >0.75-0.9 as good reliability and values >0.9 as excellent reliability.[17]

RESULTS

Content Validity

For the knowledge domain, five subdomains namely diabetes mellitus, systemic lupus erythematosus, bronchial asthma, epilepsy and thrombocytopenia disorders in pregnancy were developed. There was a total of 34 items in this domain. All knowledge items achieved a satisfactory I-CVI score for relevance, clarify and representativeness. On the other hand, all items reported excellent Kappa values, except item K10, K21 and K22 which reported a good Kappa value. With regards to the attitude domains, all items achieved excellent I-CVI and Kappa values. In the practice domains, all items achieved excellent I-CVI and Kappa values. Also, the S-CVI for the knowledge, attitude and practice domains were 0.994, 1.000 and 0.971 respectively. Overall, majority of the items that achieved good to excellent validity, and they were mainly corrected to improve the grammar, understandability and specificity (Table I).

Face Validity

With respect to face validity, it involved a total of 10 participants from medical department of a tertiary hospital (five medical officers with varying degree of clinical experience, one general physician and two medical consultants), and a health clinic (one medical officer and one family medicine specialist).

The mean time required to complete the questionnaire was approximately 7 minutes and all commented that the questionnaire was easy to understand. Of note, one participant commented that P1 response could be influenced by the Coronavirus disease 2019 (COVID-19) pandemic, whilst another participant remarked that the caution should be taken in designing items with binomial response (true vs false) in order to avoid ambiguous items. Nevertheless, the overall comments were positive, and they opined those clinicians with regular exposure to maternal healthcare would be able to answer this questionnaire more confidently.

Pre-Pilot Testing Questionnaire Amendment

For the knowledge domains, item K10, K21 and K22 were deleted due to their comparatively lower Kappa values. Further, item K10 was commented as not a practical question for clinicians working in health clinics or remote setting as anti-double stranded DNA antibodies test are not widely available, item K21 was commented as not specific as the frequency of follow up would largely depend on the disease control and gestational age, and item K22 was commented as too easy. In addition, item K13 was commented as not clear as the aspirin dose was not defined and most clinicians do not practise prescribing aspirin as pre-eclampsia prophylaxis in mothers with SLE. Item K1 was deleted to reduce to total number of items in the final questionnaire.

In the attitude domain, item A7 was deleted in order to reduce to total number of items in the final questionnaire. With regards to the practice domain, item P1 and P9 were deleted from the practice domain to reduce the total number of items due to concern about fatigue bias.

Demographic Profile

A total of 168 respondents participated in the pilot study, represented by clinicians from four healthcare centres, namely Tengku Ampuan Rahimah Hospital (HTAR), Botanik Health Clinic, Pandamaran Health Clinic and Bukit Kuda Health Clinic. The participants were predominantly from HTAR, which constituted 79.2% of the total respondents (n = 133), while the remaining participants were from three health clinics in Klang district (n = 35, 20.8%). The median age of the participants was 32-year-old with a female preponderance, in which 70.8% of them were female gender (n = 119). Majority of the participants were medical officers (n = 127, 75.6%), followed by general physicians (n = 19, 11.3%), subspecialist or subspecialty trainee (n = 17, 10.1%), parallel pathway trainee (n = 2, 1.2%), master programme trainee (n = 2, 1.2%) and family medicine specialist (n = 1, 0.6%). Analysis of the clinical service experience showed that majority of the respondents had clinical service experience of less than 5 years (n = 93, 55.3%) (Table II).

Construct Validity

Item K13 was removed following pilot testing due to ambivalent answer. EFA was applied to determine the factor structure among 29 items related to the knowledge domain. Upon input of the 29 items, K28 was excluded in the analysis by the software due to similarity of item. Several well-known criteria for the factorability of a correlation were used. Firstly, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.648, above the suggested value of 0.6, and Bartlett's test of sphericity was significant ($\chi 2_{(378)}$ =1805.6, p <0.05). In the current study, all loading factors were above 0.3. The results of EFA on all 28 items extracted four factors based on the parallel analysis. The Eigenvalues and total variance explained by the four factors is shown in Table III.

The results after Promin rotation showed that the first factor explained 16.337% of the variance, with the final set including five items after deleting item K3 due to negative factor loading as well as item K30 and K32 in view of cross loading. It is grouped under medication safety during pregnancy.

Following that, the second factor explained 8.077% of the variance, with final set including eight items after deleting item K11 due to cross loading. It was labelled as family planning and breastfeeding compatibility among mothers with medical disorders. The third factor explained 7.244% of the variance, with the final set including five items were

Table I: Content validation of knowledge, attitude and practice domains for medical disorders in pregnancy

Item	Relevance		Clarity		Representativeness		RESULTS
	I-CVI (Item content validity index)	Kappa	I-CVI (Item content validity index)	Kappa	I-CVI (Item content validity index)	Kappa	
		Knowledge domain					
K1	0.857	0.849	0.857	0.849	0.857	0.849	DELETED
K2	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K3	1.000	1.000	0.857	0.849	1.000	1.000	CORRECTED
K4	1.000	1.000	1.000	1.000	0.857	0.849	VALIDATED
K5	1.000	1.000	0.857	0.849	1.000	1.000	CORRECTED
K6	1.000	1.000	0.857	0.849	1.000	1.000	CORRECTED
K7	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K8	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K9	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K10	0.714	0.658	1.000	1.000	0.857	0.849	DELETED
K11	1.000	1.000	0.857	0.849	1.000	1.000	VALIDATED
K12	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
K13	1.000	1.000	0.857	0.849	1.000	1.000	CORRECTED
K14	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
K15	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K16	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K17	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K18	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K19	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K20	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K21	0.857	0.849	0.714	0.658	0.857	0.849	DELETED
K22	1.000	1.000	1.000	1.000	0.714	0.658	DELETED
K23	1.000	1.000	0.857	0.849	1.000	1.000	VALIDATED
K24	0.857	0.849	0.857	0.849	0.857	0.849	CORRECTED
K25	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
K26	1.000	1.000	1.000	1.000	0.857	0.849	CORRECTED
K27	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
K28	1.000	1.000	1.000	1.000	0.857	0.849	VALIDATED
K29	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K30	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K31	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K32	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K33	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
K34	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
		Attitude domain					
A1	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
A2	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
A3	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
A4	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
A5	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
A6	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
A7	0.857	0.849	1.000	1.000	0.857	0.849	DELETED
A8	1.000	1.000	1.000	1.000	1.000	1.000	CORRECTED
		Practice domain					
P1	0.857	0.849	0.857	0.849	1.000	1.000	DELETED
P2	0.857	0.849	0.857	0.849	1.000	1.000	VALIDATED
P3	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
P4	1.000	1.000	0.857	0.849	1.000	1.000	CORRECTED
P5	1.000	1.000	0.857	0.849	1.000	1.000	CORRECTED
P6	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
P7	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
P8	1.000	1.000	1.000	1.000	1.000	1.000	VALIDATED
P9	1.000	1.000	0.857	0.849	1.000	1.000	DELETED

categorised as natural history of maternal medical disorder and pre-pregnancy optimisation among mothers with medical disorders.

Lastly, the fourth factor explained 7.089% of the variance, with the final set including four items which explained the foetal outcome, peri-labour issues and antenatal care. Also, item K19 and K31 were deleted due to poor loading factors (<0.3) (Table III).

Reliability

Pertaining to the reliability of this questionnaire, test-retest responses from 30 participants were analysed. Majority of the knowledge items achieved moderate to substantial Kappa value. To note, K8 showed a perfect percentage of agreement, whilst K29 reported low Kappa value, yet the percentage of agreement was 60% and above. Kappa statistical analysis was not applicable to K6, K7, K8, K16 and K20 in view of inability to construct a symmetrical table. Nevertheless, they

Table II: Demographic characteristics of participants

Characteristics	N = 168
Age in years, median (IQR)	32 (8)
Male gender, n (%)	49 (29.2)
Place of practice, n (%)	
Tengku Ampuan Rahimah Hospital	133 (79.2)
Botanik Health Clinic	12 (7.1)
Pandamaran Health Clinic	12 (7.1)
Bukit Kuda Health Clinic	11 (6.6)
Present designation, n (%)	
Medical officer	127 (75.6)
General physician	19 (11.3)
Subspecialist/trainee	17 (10.1)
Parallel pathway trainee	2 (1.2)
Master programme trainee	2 (1.2)
Family medicine specialist	1 (0.6)
Clinical service experience, n (%)	
Less than 2 years	53 (31.5)
2 to less than 5 years	40 (23.8)
5 to less than 10 years	31 (18.5)
10 years and above	44 (26.2)

IQR, Interquartile range

demonstrated a more than 83% of agreement during the test-retest (Table IV).

In the attitude domains, A2 and A8 were deleted due to low reliability. The final Cronbach's alpha value of this domain was 0.787, suggesting adequate internal reliability. In addition, the corrected item total correlation ranged between 0.352 to 0.801, which were more than 0.3 indicating all the items have adequate correlation with the total score of the domains.[21] This was further supported by the ICC coefficients of all the attitude items, which demonstrated moderate to good reliability (ICC>0.5) (Table V).

For the practice domain, all items reported moderate to near complete agreement, except item P5 and P7. Lastly, P2.5 was retained despite the insignificant confidence interval as this question is considered as clinically relevant. In essence, this questionnaire had adequate reliability (Table VI)

The Final Questionnaire

The final set questionnaire contained 36 items as follow: 22 items measuring the knowledge towards medical disorders in pregnancy; five items assessing the attitude of medical disorders in pregnancy and nine items reflecting practice towards medical disorders in pregnancy. Overall, it demonstrated acceptable psychometric properties, and has good validity and reliability towards the construct measured.

DISCUSSION

According to Jolving et al, there had been greater than four-fold increase in maternal chronic disease during pregnancy in Denmark.[22] The most notable contributing factors to this observation are delayed childbearing and increased prevalence of non-communicable diseases among the reproductive age population. Also, with the advent of assisted reproductive technology for sub-fertile couples, this has made conception possible in most women, especially mothers with chronic medical disorders.[23] Hence, the maternal medicine discipline is integral in ensuring the provision of special medical care for this group of mothers who need additional attention compared to their peers without medical disorder.

Maternal medicine has gained a renewed interest among clinicians as well as obstetrician in recent years. Several questionnaires have been developed or adapted to explore the KAP of medical disorders among the clinicians. In this regard, Bolla et al and Appajigol et al reported the existence of knowledge gap in diabetes care among the clinicians, and they concurred there is a need to improve training in the area of diabetes and pregnancy.[24,25] These findings highlight the importance of periodic maternal medicine KAP assessment among clinicians, and to fill the knowledge gap regularly via medical education. To date, most of the published questionnaires regarding maternal medicine only focus on a single disease entity which are inadequate to examine the full spectrum of maternal medicine.[6-8,24,25] Therefore, development of an inclusive instrument assessing the KAP towards important medical disorders in pregnancy is crucial, and our questionnaire had been proven to be capable of measuring these constructs.

A rigorous re-evaluation on the items was performed based on the reliability and EFA results to determine the items to be retained in the final set of questionnaires. Despite having a relatively low Kappa value, item K29 was retained in the final instruments as it was considered as clinically important knowledge pertaining to the natural history of the relevant disorder. Besides, it has achieved an acceptable percentage of agreement (> 50%). In a different note, item K13 was removed following pilot testing. This was by virtue of differing recommendation towards that practice in the present literature. Finally, EFA analysis which was undertaken to examine the construct validation exhibited a good psychometric property of the knowledge domains with the factor loadings ranging from 0.354 to 0.77.

Admittedly, this study was conducted during COVID-19 pandemic, whereby most of the workforce had been diverted to COVID-19 wards and most of the clinic appointments had

Table III: Exploratory factor analysis for knowledge domain

Items	Factor 1	Factor 2	Factor 3	Factor 4	
K4	0.609				Metformin should be discontinued in women who are already on metformin before pregnancy.
K24	0.607				Women on levetiracetam tend to have an increase in serum Levetiracetam level during second and third trimester
K14	0.576				Cyclophosphamide can be safely continued in pregnant mothers with lupus nephritis.
K5	0.548				Pre-mixed insulin is the preferred type of insulin during pregnancy.
K23	0.539				Sodium valproate should be avoided in reproductive-age women considering pregnancy.
K18		0.617			Leukotriene receptor antagonists should be avoided in pregnant mothers with depressive disorder.
K29		0.564			Thrombocytopenia occurs in 8 to 10% of all pregnancies.
K17		0.563			Theophylline therapy is absolutely contraindicated during pregnancy.
K26		0.533			Oral contraceptives are the contraceptive of choice in mothers taking carbamazepine.
K7		0.519			Women with a history of gestational DM should undergo at least annual screening for diabetes.
K34		0.429			In pregnant women with immune thrombocytopenia who require oral prednisolone therapy, the recommended starting dose is generally higher than non-pregnant counterparts.
K12		0.414			Breastfeeding should be avoided in mothers on hydroxychloroquine therapy.
K25		0.354			Mothers on anti-epileptic therapy should be discouraged from breastfeeding.
K15			0.77		Asthma exacerbation is generally less common during second trimester.
K20			0.680		Uncontrolled bronchial asthma is associated with adverse maternal and foetal outcomes.
K6			0.537		Women with essential hypertension should be screened for DM in pregnancy at 24-28 weeks of conception.
K9			0.504		The prognosis of the pregnancy is best when SLE has been quiescent for at least three months prior to conception.
K2			0.428		Women with pre-existing DM who plan for pregnancy should aim for HbA1c < 7.5% pre-conception.
K8				0.766	Antiphospholipid syndrome should be suspected in mothers with SLE who have had recurrent unexplained miscarriages.
K27				0.653	Antiepileptic drugs polytherapy is associated with increased risk of foetal malformation.
K16				0.572	Pregnant women who require oral steroid to achieve adequate asthma control should be follow up in specialist clinic.
K33				0.483	A safe platelet level for spontaneous vaginal delivery has been defined as >50 × 10^9/L.
Eigenvalues	4.574	2.262	2.028	1.985	
Percentage of variance (%)	16.337	8.077	7.244	7.089	

Extraction method: Principal component analysis Rotation method: Varimax with Kaiser normalisation

been adjourned during the peak of COVID-19 pandemic. Yet, despite the reduced exposure to maternal medicine, all respondents demonstrated a positive attitude and unanimously opined that knowledge towards medical disorders in pregnancy was important and should be incorporated in both undergraduate and post-graduate training.

Of utmost importance, this questionnaire represents the first validated instrument in measuring KAP towards medical disorders in pregnancy that has incorporated five clinically important medical disorders in pregnancy. Furthermore, by having a non-native expert validation in this questionnaire, it reduces possible biases associated with local practice and increases the acceptability of this questionnaire overseas. In addition, the considerably short answering time required provides evidence about the clarify of the questionnaire and also the low probability of fatigue bias among the respondents. Lastly, it provides a validated framework to the researchers in measuring the KAP towards these constructs. Importantly, we believe utilisation of such findings will provide policy makers insight in formulating future medical training programme that would enhance the field of maternal medicine. It is hope that future researchers would continue to validate this instrument in other population, and to consider expanding the number of items by including more medical disorders to be assessed.

Table IV: Reliability testing of knowledge domain for medical disorders in pregnancy

Item	Coefficient of agreement (Kappa)	Percentage of agreement (%)
K2	0.713	86.67
K4	0.632	83.33
K5	0.483	70.00
K6	NC	83.33
K7	NC	86.67
K8	NC	100.00
K9	0.558	70.00
K12	0.600	73.33
K14	0.360	73.33
K15	0.358	66.67
K16	NC	96.67
K17	0.490	66.67
K18	0.438	70.00
K20	NC	93.33
K23	0.620	80.00
K24	0.659	80.00
K25	0.284	60.00
K26	0.525	70.00
K27	0.314	76.67
K29	0.130	60.00
K33	0.453	70.00
K34	0.392	60.00

NC, not calculated (Unable to construct a symmetrical table)

Table V: Internal consistency reliability and intra-class correlation coefficients of the items in the test-retest of attitude domain for medical disorders in pregnancy

Item	Corrected item-total correlation	Cronbach's alpha if item deleted	ICC	95% CI
A1	0.352	0.808	0.744	(0.462, 0.878)
A3	0.382	0.817	0.737	(0.448, 0.875)
A4	0.678	0.713	0.828	(0.640, 0.918)
A5	0.689	0.703	0.847	(0.678, 0.927)
A6	0.801	0.672	0.699	(0.367, 0.857)

ICC, intra-class correlation coefficient; CI, confidence interval

Table VI: Intra-class correlation coefficients of the items in the test-retest of practice domain for medical disorders in pregnancy

Item	ICC	95% CI
P2.1	0.766	(0.508, 0.889)
P2.2	0.803	(0.586, 0.906)
P2.3	0.970	(0.937, 0.986)
P2.4	0.803	(0.586, 0.906)
P2.5	0.519	(-0.011, 0.771)
P3	0.890	(0.769, 0.948)
P4	0.798	(0.576, 0.904)
P6	0.807	(0.594, 0.908)
P8	0.722	(0.417, 0.868)

ICC, intra-class correlation coefficient; CI, confidence interval

CONCLUSION

In conclusion, this instrument has been proven to be a reliable and valid tool in the assessment of knowledge, attitude and practice (KAP) towards medical disorders in pregnancy or maternal medicine. The inclusiveness of this questionnaire lies in the presence of five clinically important diseases in the knowledge domains, which allows a general assessment of one's knowledge towards maternal medicine. Furthermore, the assessment outcomes would enable better informed strategies by researchers, policy makers and clinicians to optimise the care of mothers with medical disorders.

ACKNOWLEDGEMENT

We are indebted to Dr Eashwary (rheumatology consultant), Dr Xavier Sim Yoon Han (haematology consultant), Dr Lee Li Yuan (general physician consultant), Dr Yong Sy Liang (endocrinology consultant), Dr Ho Bee Kiau (family medicine consultant), Dr Tee Teng Teng (respiratory physician), Dr Tee Sow Kuan (neurology consultant) and Prof Paulo Pires (professor from Lurio University, Mozambique) for their reviews and invaluable opinions. Further, we would also like to extend our appreciation towards all the respondents in this study. Lastly, we would like to thank Director General of Health Malaysia for his permission to publish this article.

REFERENCES

1. Nelson-Piercy C. Obstetric medicine training: picking up where the licentiate in midwifery left off. Clin Med 2002; 2(2): 119-21.
2. Sudziute K, Murauskiene G, Jariene K, Jaras A, Minkauskiene M, Adomaitiene, Nedzelskiene I. Pre-existing mental health disorders affect pregnancy and neonatal outcomes: a retrospectivecohort study. BMC Pregnancy Childb 2020; 20(1): 419.
3. Dunlop AL, Jack BW, Bottalico JN, Lu MC, James A, Shellhaas CS, Prasad MR. The clinical content of preconception care: women with chronic medical conditions. Am J Obstet Gynecol 2008; 199(6 Suppl 2): S310 S327. doi: 10.1016/j.ajog.2008.08.031.
4. Narayan B, Nelson-Piercy C. Medical problems in pregnancy. Clin Med 2017; 17(3): 251–7.
5. Chuang CH, Velott DL, Weisman CS. Exploring knowledge and attitudes related to pregnancy and preconception health in women with chronic medical conditions. Matern Child Health J 2010; 14(5): 713-9.
6. Clowse MEB, Eudy AM, Revels J, Neil L, Sanders GD. Provider perceptions on the management of lupus during pregnancy: barriers to improved care. Lupus 2019; 28(1): 86-93.
7. Adeleke NA, Olowookere SA, Farinloye EO, Abiodun OM, Alebiosu CO. Management of gestational diabetes mellitus at secondary health care level: a survey of ante-natal care givers' knowledge, attitude and practice. Res. J. Health Sci 2014; 2(2): 79-89.
8. Elnaeim AK, Elnaeim MK, Babiker IBA. Knowledge of women issues and epilepsy among doctors in Sudan. Epilepsy Behav 2018; 84: 79-82.
9. Gupta M, Pradeep Y, Singh R, Shrivastava, PK. A study of neurological disorders in pregnancy and puerperium. Int J Reprod Contracept Obstet Gynecol 2020; 9(10).
10. Kwon HL, Triche EW, Belanger K, Bracken MB. The epidemiology of asthma during pregnancy: prevalence, diagnosis, and symptoms. Immunol Allergy Clin North Am 2006; 26(1): 29-62.
11. Mohseni M, Asgarlou Z, Azami-Aghdash S, Sheyklo SG, Tavananezhad N, Moosavi A. The global prevalence of thrombocytopenia among pregnant women: a systematic review and meta-analysis. Nurs Midwifery Studs 2019; 8(2): 57-63.
12. Negrato CA, Mattar R, Gomes MB. Adverse pregnancy outcomes in women with diabetes. Diabetol Metab Synd 2012; 4(1).
13. Pastore DEA, Costa ML, Surita FG. Systemic lupus erythematosus and pregnancy: the challenge of improving antenatal care and outcomes. Lupus 2019; 28(12): 1417-26.
14. Royal College of Obstetricians and Gynaeoclogists. (2019). Core module 9: Maternal medicine. Accessed from: https://www.rcog.org.uk/en/careers-training/specialty-training-curriculum/core-curriculum/previous/pre-august-2019/core-module-9-maternal-medicine/.
15. Hair JF, Black WC, Babin BJ, Anderson RE. (2010). Multivariate Data Analysis. 7th Edition. Pearson Prentice Hall.
16. Boparai JK, Singh S, Kathuria P. How to design and validate a questionnaire: a guide. Curr Clin Pharmacol 2018; 13(4): 210-15.
17. Sahu KK, Chavan BS, Bala C, Tyagi S. Reliability and validity of the Screening tool for assessment of psychosocial problems. Open J Psychiatry Allied Sci 2019; 10(2).
18. Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations. Res Nurs Health 2006; 29(5): 489-97.
19. Lorenzo-Seva U, Ferrando PJ. FACTOR: A computer program to fit the exploratory factor analysis model. Behav Res Methods 2006; 38(1): 88-91.
20. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biom 1977; 33(1): 159-74.
21. Vaus DD. (2004). Survey in Social Research. 5 th Edition. London Routledge.
22. Jolving LR, Nielsen J, Kesmodel US, Nielsen RG, Beck-Nielsen SS, Norgard BM. Prevalence of maternal chronic diseases during pregnancy: a nationwide population based study from 1989 to 2013. Acta Obstet Gynecol Scand 2016; 95(11): 1295-304.
23. Johnson J.-A, Tough S, Wilson RD, Audibert F, Blight C, BrockS JA, Okun N. Delayed child-bearing. J Obstet Gynaecol Can 2012; 34(1): 80-93.
24. Bolla AM, Dozio N, Scavini M, Succurro E, Tumminia A, Torlone E, et al. Awareness about diabetes and pregnancy among diabetes specialists and fellows: The YoSID diabetes and pregnancy project. Nutr Metab Cardiovasc Dis 2020; 30(9): 1520-4.
25. Appajigol J, Bellary S. Knowledge and practices of rural family physicians and obstetricians towards gestational diabetes mellitus. Int J Community Med Public Health 2015; 2(2).